

Neutron-Anti-Neutron Development

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How We Got Here

- ❖ Collaboration is being formed to pursue new search for neutron-anti-neutron oscillations using intense ESS cold neutron flux
 - Expect to improve sensitivity by $\mathcal{O}(500)$
 - www.nnbar-at-ess.org
- ❖ Question arose: what can be done at BNL?
 - Not a competitive oscillation experiment
 - At least not horizontal
 - (Semi-)vertical??
 - Discuss this over coffee or beer
 - Neutron test beams?
 - Other things “NNbar enthusiasts” are interested in?

Neutron-Anti-Neutron Oscillations at ESS

12-13 June 2014, CERN, Geneva, Switzerland



Neutral particle oscillations have proven to be extremely valuable probes of fundamental physics. Kaon oscillations provided us with our first insight into CP-violation, fast Bs oscillations provided the first indication that the top quark is extremely heavy, B oscillations form the most fertile ground for the continued study of CP-violation, and neutrino oscillations suggest the existence of a new, important energy scale well below the GUT scale. Neutrons oscillating into antineutrons could offer a unique probe of baryon number violation.

The construction of the European Spallation Source in Lund, with first beam expected in 2019, together with modern neutron optical techniques, offers an opportunity to conduct an experiment with at least three orders of magnitude improvement in sensitivity to the neutron oscillation probability.

At this workshop the physics case for such an experiment will be discussed, together with the main experimental challenges and possible solutions. We hope the workshop will conclude with the first steps towards the formation of a collaboration to build and perform the experiment.

Organising committee:

- G. Brooijmans (Columbia University)
- S. Chattopadhyay (Cockcroft Institute)
- R. Hall-Wilton (European Spallation Source)
- Y. Kamyshkov (University of Tennessee)
- E. Kinkby (Technical University of Denmark and European Spallation Source)
- M. Lindroos (European Spallation Source and Lund University)
- L. Mapelli (CERN)
- M. Mezzetto (INFN Padova)
- H. M. Shemizu (Nagoya University)
- W. M. Snow (Indiana University)
- T. Soldner (Institut Laue Langevin)
- C. Thorne (European Spallation Source)

Register before
19 May on
www.nnbar-at-ess.org

ESS EUROPEAN SPALLATION SOURCE CERN

Goals

❖ Opportunity to brainstorm

- Talks meant to plant seeds
 - Information about what exists or is planned or may be of interest
 - Happy to discuss substantially different things
- Good ideas often need (a lot of) refinement
 - Initial thoughts can be far off the mass shell...

Talks

❖ G. Muhrer

- European Spallation Source: State of the art neutron spallation source
 - Can BNL offer complementary beams to help make ESS experiments a success?

❖ Y. Kamyshev

- Neutron regeneration

❖ R. Pattie

- Fast and cold neutron test beams

❖ A. Saunders

- Proton radiography at BNL?